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REMARKS

The application has been reviewed in light of the Office Action dated October 3, 2007. Claims 1-5 are pending. By this Amendment, claims 1-5 have been amended to clarify the claimed subject matter. Accordingly, claims 1-5 are presented for reconsideration, with claims 1 and 5 being in independent form.

The Office Action indicated that the application does not contain an abstract.

The Examiner is respectfully referred to page 47 of the disclosure as originally filed (see computer printout, attached as Exhibit A hereto, of an index of the Image File Wrapper for this application in PAIR). The abstract in the disclosure as originally filed is also present in publication no. US 2006/0146080 A1 of this application.

Claims 1-5 were objected to as having informalities.

In response, the claims have been carefully reviewed and amended with particular attention to the points raised in the Office Action.

Withdrawal of the objection to the claims is respectfully requested.

Claims 1, 2 and 5 were rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over U.S. Patent No. 6,540,326 to Matsubara et al. in view of U.S. Patent No. 6,318,832 to Bates et al. and further in view of U.S. Patent No. 6,273,542 to Couwenhoven et al. Claim 4 was rejected under 35 U.S.C. § 103(a) as purportedly unpatentable over Matsubara in view of Bates and Couwenhoven and further in view of U.S. Patent No. 6,170,932 to Kanaya et al.

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1 and 5 are patentable over the cited art, for at least the following reasons.

This application relates to improvements devised by applicant that enable an ink jet

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printing device to avoid occurrence of color inconsistency in an image printed on a recording medium and to attain high-quality printing by maintaining an impact sequence of the ink (without reversing direction in the impact sequence) in a case of printing at a high resolution higher than a resolution determined according to an array interval of the discharge nozzles of a head unit of the printing device.

In an aspect of the present application, such an ink jet printing device is provided which comprises a head unit in which a plurality of recording heads having discharge nozzles which discharge ink droplets of different colors respectively are arranged in a main scanning direction, and the discharge nozzles of each of the recording heads are arranged at equal intervals in a sub-scanning direction which is perpendicular to the main scanning direction, a head unit moving unit, a recording-medium moving unit, and a control unit (1) configured to carry out printing procedures including steps of moving the recording medium to the printing region to perform the discharging of the ink droplets, and moving the recording medium in the sub-scanning direction by an interval represented by H/k (where H is an array interval of the discharge nozzles in the sub-scanning direction and k is an integer greater than one), to perform the discharging of the ink drops to a non-printed region equivalent to the array interval H of the discharge nozzles, and to repeat the printing procedures k times according to an ink dot density, and thereafter move the recording medium in the sub-scanning direction so that the head unit is located to a next non-printed region following the printing region and the printing procedures are performed for the next non-printed region, and (2) configured so that a rear-end portion of the discharge nozzles of the k^{th} printing procedure in an array direction after printing of the printing region and a front-end portion of the discharge nozzles of the k^{th} printing procedure in the array direction before printing of the non-printed region overlap each other with respect to the sub-scanning direction,

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and invalid nozzles that do not discharge the ink drops are determined from among arbitrary ones of the discharge nozzles in the overlap between the front-end portion and the rear-end portion in the array direction of the discharge nozzles. Each of independent claims 1 and 5 addresses these features, as well as additional features.

In short, in the above-mentioned approach, the overlapping discharge nozzles are determined in the k^{th} printing procedure, as illustrated exemplarily in Fig. 6 of the application. The Examiner is respectfully referred also to paragraphs [0075] through [0078] of the application.

When such an ink jet printing device prints at a high resolution higher than the resolution determined according to the array interval of the discharge nozzles, and when the recording medium is moved in the sub-scanning direction greatly so that the head unit is located at a non-printed region of the recording medium and discharging of ink drops is performed at such location, the impact sequence of the ink drops of one color at transitional locations between discharge nozzles of the rear-end portion of the head unit and discharge nozzles of the front-end portion of the head unit can be in accordance with the impact sequence of ink drops of another color. Therefore, by covering the whole recording medium and maintaining the impact sequence of the ink drops without reversing direction in impact sequence, the ink jet printing device of the present application can prevent an occurrence of color inconsistency on the recording medium and attain high-quality printing.

Matsubara, as understood by Applicant, proposes an ink jet recording apparatus configured for increasing print density, wherein paper feed operation is performed by a width not less than one pixel in addition to an integer multiple number of pixels with respect to basic pixels inherent to the ink jet recording apparatus, and when plural pixel recording operations are

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performed for a single pixel region, ink dots land within a distance less than one pixel unit.

Matsubara, as acknowledged in the Office Action, does not disclose or suggest, however, a control unit configured so that a rear-end portion of the discharge nozzles of the k^{th} printing procedure in an array direction after printing of the printing region and a front-end portion of the discharge nozzles of the k^{th} printing procedure in the array direction before printing of the non-printed region overlap each other with respect to the sub-scanning direction, and invalid nozzles that do not discharge the ink drops are determined from among arbitrary ones of the discharge nozzles in the overlap between the front-end portion and the rear-end portion in the array direction of the discharge nozzles, as provided by the subject matter of claim 1 of the present application.

Bates, as understood by Applicant, proposes an approach for high resolution printing wherein the ink jet printer is controlled to print on a print medium a pattern of dots consisting of at least four interlaced checkerboard arrays of dots in four passes of the print head across the print medium, where each of the four checkerboard arrays is printed during a different one of the four passes and is offset from the other checkerboard arrays by a predetermined spacing in at least one of the first and second directions.

As implicitly acknowledged in the Office Action, Bates, like Matsubara, does not disclose or suggest, however, a control unit configured so that a rear-end portion of the discharge nozzles of the k^{th} printing procedure in an array direction after printing of the printing region and a front-end portion of the discharge nozzles of the k^{th} printing procedure in the array direction before printing of the non-printed region overlap each other with respect to the sub-scanning direction, and invalid nozzles that do not discharge the ink drops are determined from among arbitrary ones of the discharge nozzles in the overlap between the front-end portion and the rear-

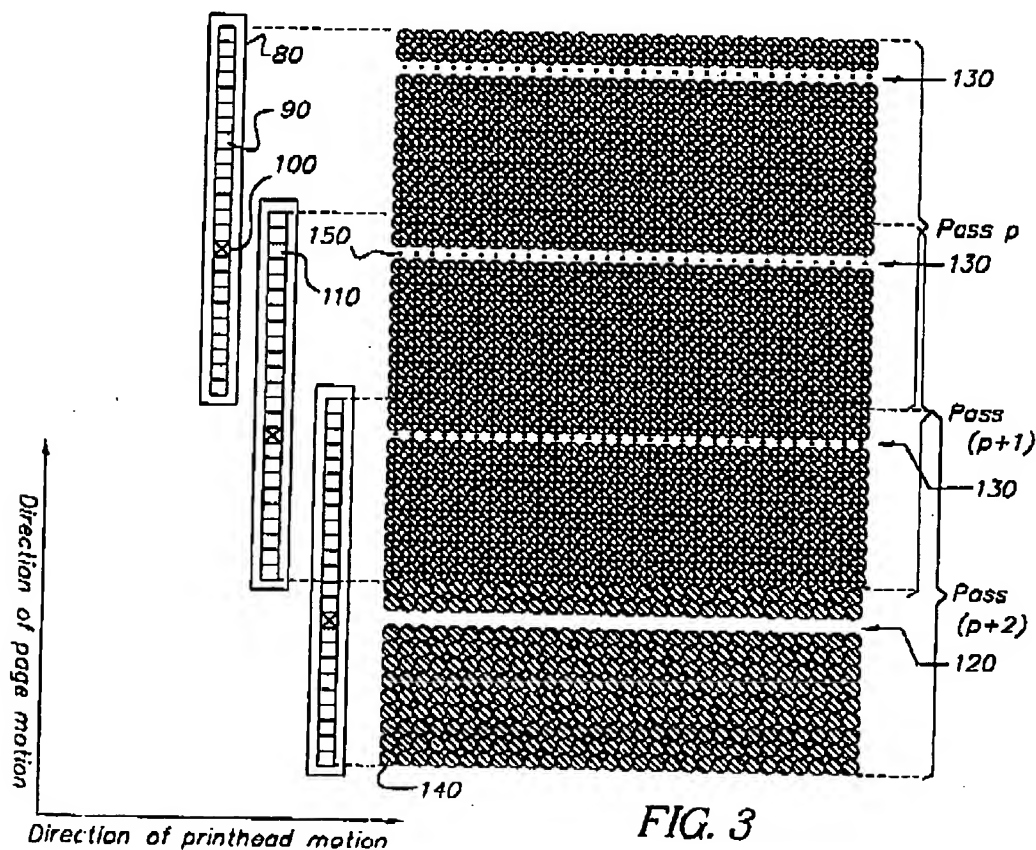
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end portion in the array direction of the discharge nozzles, as provided by the subject matter of claim 1 of the present application.

Couwenhoven, as understood by Applicant, proposes an approach for compensating for malperforming nozzles in an inkjet printing device wherein printed image pixels have one of two or more states (each state corresponding to a volume of ink) according to a swath data signal, and a printing process includes assigning to each state a corresponding state importance value, assigning to each nozzle a corresponding nozzle malperformance value, computing a modified swath data signal based on the swath data signal, the state importance value, and the nozzle malperformance value, and printing pixels based on the modified swath data signal.

Fig. 3 (reproduced below) of Couwenhoven was cited in the Office Action.



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As discussed in Couwenhoven, column 5, line 11, through column 6, line 8, Couwenhoven merely proposes that the printer can have a multi-pass interlaced print mode wherein the passes overlap as shown in Fig. 3 of Couwenhoven.

Contrary to the contention in the Office Action, Couwenhoven, like Matsubara and Bates, does not disclose or suggest, however, a control unit configured so that a rear-end portion of the *discharge nozzles of the k^{th} printing procedure* in an array direction after printing of the printing region and a front-end portion of the *discharge nozzles of the k^{th} printing procedure* in the array direction before printing of the non-printed region overlap each other with respect to the sub-scanning direction, and *invalid nozzles that do not discharge the ink drops are determined from among arbitrary ones of the discharge nozzles in the overlap between the front-end portion and the rear-end portion in the array direction of the discharge nozzles*, as provided by the subject matter of claim 1 of the present application.

Kanaya, as understood by Applicant, proposes an approach for alleviating banding effects in printing wherein secondary scans are carried out in an interlacing manner.

Applicant does not find teaching or suggestion in the cited art, however, of an ink jet printing device including a control unit configured so that a rear-end portion of the *discharge nozzles of the k^{th} printing procedure* in an array direction after printing of the printing region and a front-end portion of the *discharge nozzles of the k^{th} printing procedure* in the array direction before printing of the non-printed region overlap each other with respect to the sub-scanning direction, and *invalid nozzles that do not discharge the ink drops are determined from among arbitrary ones of the discharge nozzles in the overlap between the front-end portion and the rear-end portion in the array direction of the discharge nozzles*, as provided by the subject matter of claim 1 of the present application.

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Independent claim 5 is patentably distinct from the cited art for at least similar reasons.

Accordingly, for at least the above-stated reasons, Applicant respectfully submits that independent claims 1 and 5, and the claims depending therefrom, are patentable over the cited art.

The Office Action indicates that claim 3 was objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

However, since independent claim 1 from which claim 3 depends is submitted to be patentable over the cited art, no changes to the form of claim 3 are believed to be necessary.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge any fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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